Final settling tank

Purpose:

1- Clarifying the waste water from all suspended matters organic and inorganic.

2- Sediment the suspended matters to return a part of it to achieve the oxidization process.

Design criteria: (in case of aeration tank)

Qd = Q + Qr.s m^3/d

Solid load = 3 $kg/m^2/hr$ at average flow

= 8 $kg/m^2/hr$ at peak flow

$$A = \frac{Q_d \times MLSS}{Solid\ load \times 1000}$$

No. of final settling tank (F.S.T) ≥ 2

d = 2.5 – 4.5 m

Φ ≤ 40 m

Hydraulic weir loading = 100 – 150 $m^3/m/d$

Surface loading rate = 16 - 32 $m^3/m^2/d$ at average flow

= 40 – 50 $m^3/m^2/d$ at peak flow

T = V / Qd   (2 - 3 hrs)

Design criteria: (in case of trickling filter)

Qd = Q + QR m^3/d

T = 1.5 – 2 hr

d = 3 – 3.5 m

No. of final settling tank (F.S.T) ≥ 2

Φ ≤ 40 m

Hydraulic weir loading = 100 – 150 $m^3/m/d$

Surface loading rate = 16 - 32 $m^3/m^2/d$ at average flow

= 40 – 50 $m^3/m^2/d$ at peak flow

Final settling tank

<u>Example:</u>

A sewage treatment plant of daily discharge 18000 m3. Find the numbers and dimensions of final settling tanks if the secondary treatment is high rate trickling filters if:

- Row sewage BOD5 =250 mg/l
- Effluent BOD5 = 40 mg/l
- BOD5 removal efficiency of primary sedimentation= 30%
- Recirculation ratio (R) is 1.5 the design flow.

<u>Solution:</u>

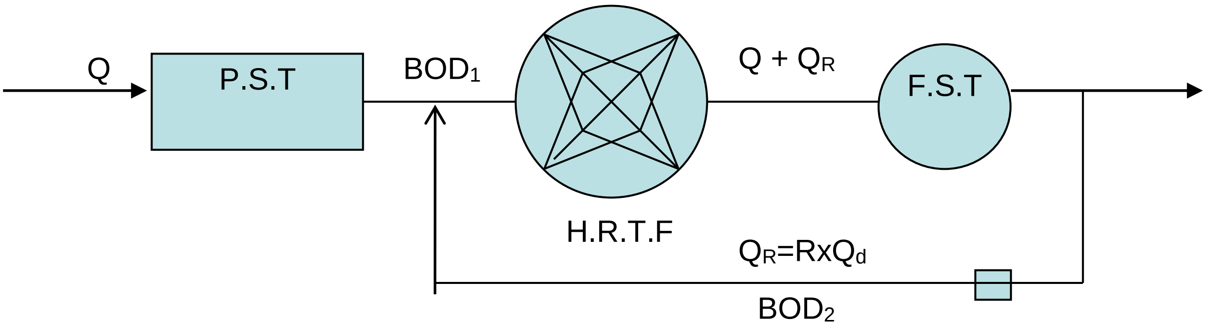
Qd = Q + QR

= 18000 + 1.5 x 18000 = 45000 m3/d

V = Qd x T   assume T = 2 hr

= 45000 x 2/24 = 3750 m3

Assume d = 3.5 m



$$A = \frac{V}{d} = \frac{3750}{3.5} = 1071.43 \quad m^2$$

$$Assume\, n = 2$$

$$A = \frac{n\,\pi\,\phi^2}{4}$$

$$1071.43 = \frac{2 \times \pi \times \phi^2}{4}$$

$$\phi = 26.12m$$

$$Chick:$$

$$S.L.R = \frac{Q_d}{A}$$

$$= \frac{45000}{1071.43} = 41.99 \quad m^3/m^2/d \quad un\,safe\,(16 - 32\,m^3/m^2/d)$$

$$Increase\,area \therefore \phi = 29.92m$$

Example:

Determine the volume and dimensions of final settling tank after aeration tanks. Which is designed to treat the flow Q = 12000 m3/d. Given the following data:

- MLVSS in aeration tank (X) = 2500 mg/l
- MLSS in return sludge = 8000 mg/l

Solution:

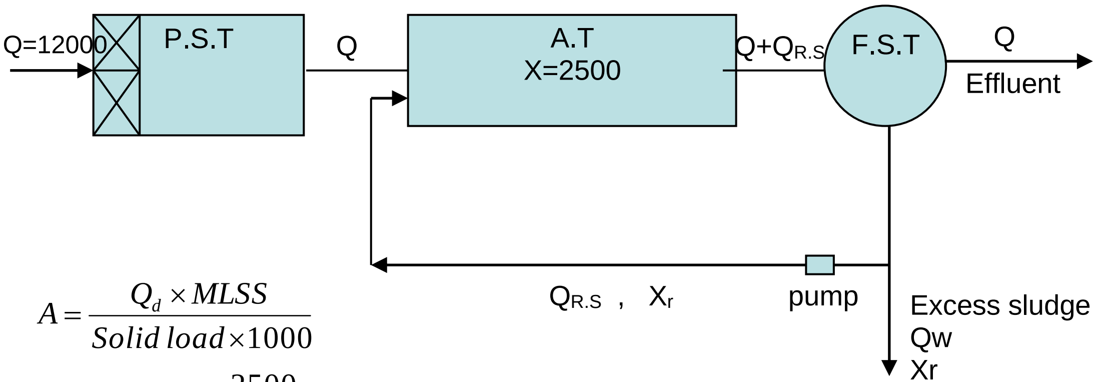
Qd = Q + Qr.s

$$\frac{Q_{r.s}}{Q} = \frac{MLSS}{TSS\ in\ r.s - MLSS}$$

$$\frac{Q_{r.s}}{Q} = \frac{\frac{2500}{0.8}}{8000 - \frac{2500}{0.8}} = 0.64$$

$$Q_{r.s} = 0.64 \times 12000 = 7692.3 \quad m^3/d$$

$$Q_d = 12000 + 7692.3 = 19692.3 \quad m^3/d$$



$$A = \frac{Q_d \times MLSS}{Solid\ load \times 1000}$$

$$= \frac{196923 \times (\frac{2500}{0.8})}{3 \times 24 \times 1000} = 854.7 \quad m^2$$

$$A = \frac{n\pi\phi^2}{4} \qquad assume\ n = 2$$

$$854.7 = \frac{2\pi\phi^2}{4} \qquad \therefore \phi = 23.33 m$$

$$Assume\ d = 3.5\ m$$

$$V = A \times d$$

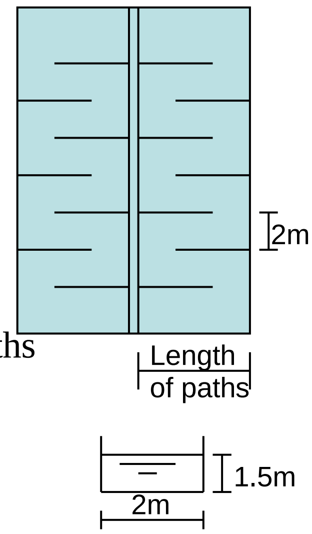
$$= 854.7 \times 3.5 = 2991.45 m^3$$

$$Chick:$$

$$SLR = \frac{Q_d}{A} = \frac{196923}{854.7} = 23.04 \quad (16 - 32\ m^3 / m^2 / d)$$

$$T = \frac{V}{Q} = \frac{2991.45}{196923} \times 24 = 3.65\ hr \quad (2 - 3\ hr)$$

Contact tank



Purpose:

Destroy bacteria.

Design criteria:

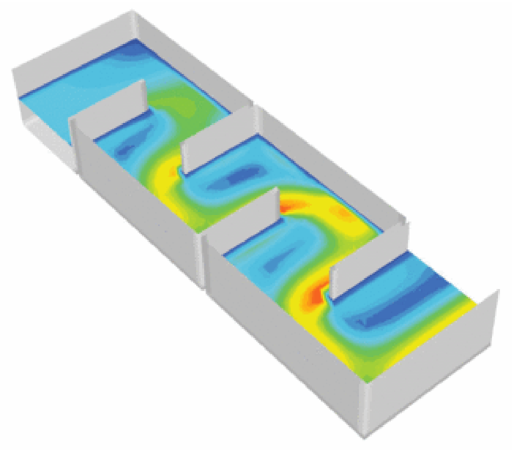
Chlorine dose = 2 – 10 P.P.M

T = 15 – 20 minutes

n $\geq$ 2

V per tank = 2 x 1.5 x length of paths x No. of paths

No. of paths = 8 – 10 channels



Chlorine gas

Contact tank

Example:

For the last example design contact tanks.

Solution:

Q_d = 12000 m^3/d

T = 15 – 20 minutes

$$V = Q_d \times T$$

$$V = 12000 \times \frac{15}{60 \times 24} = 125 \quad m^3$$

$$Assume\, n = 2$$

$$V_{one} = 2 \times 1.5 \times l \times No.of \;\; paths$$

$$\frac{125}{2} = 2 \times 1.5 \times l \times 8$$

$$l = 2.6\, m$$